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(58) Field of search
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(54) Ethylene polymer compositions

(57) Polymer composition having a density between 0.940 and 0.950 inclusively and a fluidity index less than 2 dg/min comprises 50 to 60% of at least one copolymer A of ethylene and at least one α-olefin having 3 to 12 carbon atoms, the said copolymer having a density between 0.932 and 0.940 and 40 to 50% of at least one ethylene polymer B having a density between 0.952 and 0.960, the fluidity index of A being between 1.5 and 5 dg/min, and the fluidity index of B being between 0.15 and 0.4 dg/min.

The compositions may be used for insulating conductors such as telephone wires.

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SPECIFICATION

Polymer composition for the insulation of metallic conductors

The present invention relates to polymer compositions which can be used for the insulation of metal conductors, in particular telephone wires.

For the insulation of metal wires, a man skilled in the art knows to use polyethylene having a density lower than 0.935 obtained in the presence of free radical initiators or polyethylene having a density higher than 0.955 obtained by polymerisation of ethylene in the presence of Ziegler type catalysts.

The problem to which the present invention relates is the development of ethylene polymer compositions of intermediate density, for example comprised between 0.940 and 0.950 inclusively, which when used for the insulation of electrical and telephone wires have mechanical and dielectric characteristics at least equivalent to those of the corresponding homopolymers. In order to resolve this problem, the applicant has ascertained the necessity of selecting strictly certain characteristics of the said polymers.

One object of the present invention consists of a polymer composition of density comprised between 0.940 and 0.950 inclusively and having a fluidity index lower than 2 dg/min comprising 50 to 60% by weight of at least one copolymer A of ethylene and α-olefins having 3 to 12 carbon atoms, the said copolymer having a density comprised between 0.932 and 0.940 and from 40 to 50% by weight of at least an ethylene polymer B having a density comprised between 0.952 and 0.960, characterised in that:

a) the fluidity index of the copolymer A is comprised between 1.5 and 5 dg/min, and

b) the fluidity index of the polymer B is comprised between 0.15 and 0.4 dg/min.

The fluidity indices are measured under a load of 2.16 kg at 190°C according to the Standard ASTM D 1238–73.

The composition according to the invention may also comprise from 3 to 10 parts by weight of at least one polyethylene wax of molecular weight less than 6,000 for 100 parts by weight of the mixture of copolymer A and polymer B. The presence of polyethylene wax, having a fluidity index greater than approximately 100, makes it possible to facilitate the transformation of the composition according to the invention by extrusion, in particular at high speed.

For the cellular insulation of telephone wires, the composition according to the invention also comprises up to 1.5 parts by weight of at least one porogenic agent for 100 parts by weight of the mixture of the copolymer A and of the polymer B. The porogenic agent is preferably chosen from compounds having a diazene function which decompose at approximately 170 to 230°C such as azodicarbonamide.

Advantageously, the content of α-olefin units of the copolymer A is comprised between 0.9 and 2.2% in moles. The copolymer A may contain units deriving from one or more α-olefins. Advantageously, at least one α-olefin of the copolymer A comprises at least four carbon atoms and is chosen from 1-butene, 1-hexene, 1-octene, 4-methyl-1-pentene. In this case, it may be advantageous that the distribution of the α-olefin units in the said copolymer A is heterogeneous, said copolymer comprising crystalline fractions and amorphous fractions and that the content of α-olefin units in the copolymer varies between 0.2 and 5 times their average content according to the fractions considered.

The polymer B is preferably obtained by homopolymerisation of ethylene at low pressure (less than 100 bars) and at moderate temperature (less than 100°C), in the presence of a Ziegler type catalytic system. The polymer B may also be a copolymer of ethylene and at least one α-olefin having 3 to 12 carbon atoms, preferably obtained by copolymerisation of ethylene and of at least one α-olefin under the above conditions.

The composition according to the invention is prepared from the copolymer A and the polymer B and, if necessary, from wax and/or the porogenic agent by any known means, for example by mixing and malaxating with heat before extrusion.

The compositions according to the invention have a particularly advantageous application in the insulation of metal conductors. They are used according to the technique of co-extrusion for the insulation of cables as described for example in the Encylopedia of Chemical Technology (Kirk-Othmer) Third Edition, Volume 18, pages 194–195. The compositions according to the invention make it possible to obtain high extrusion speeds, of the order of 2,000 metres/min. More particularly, the compositions containing at least one porogenic agent are intended for the cellular insulation of telephone wires. The cells obtained are closed, of small size and distributed uniformly. The insulating materials obtained have good mechanical properties (in particular compressive strength) and dielectric properties.

As is known per se, the compositions according to the invention may also contain antioxidizing agents, stabilizers, colouring agents and other additives.

The following examples are intended to illustrate the invention.

Example 1

At a temperature of 240°C the following are malaxated—50 parts by weight of a copolymer A of ethylene and 1-butene, having a density equal to 0.938 and a fluidity index

(measured according to the Standard ASTM D 1238–73) equal to 4 dg/min, comprising on average 1.2% in moles of units derived from 1-butene, sold commercially by the SOCIETE CHIMIQUE DES CHARBONNAGES under the reference LOTREX RG 0305.

—and 50 parts by weight of an ethylene polymer B sold commercially by the NAPHTACHIMIE Company under the referrence NATENE 55010 AG, having a density equal to 0.955 and a fluidity index (according to the Standard ASTM D 1238–73 equal to 0.2 dg/min.

The composition obtained having a fluidity index equal to 1.2 dg/min was extruded on an extruder carrying out the insulation of metal wires at a speed of 2,000 metres/min. The surface of the insulating material obtained has a smooth appearance.

Example 2

One carries out malaxation at a temperature of 240°C of 95 parts by weight of the composition obtaned in Example 1 and 5 parts by weight of a polyethylene wax having an average molecular mass by number (determined by gel permeation chromatography) Mn equal to 3,000.

The composition obtained (density 0.947, fluidity index equal to 1.3 dg/min) was extruded under the same conditions as Example 1. The surface of the insulating material obtained is smooth.

Example 3

Malaxation of the following is carried out at 240°C namely:

—50 parts by weight of a copolymer of ethylene and 1-butene sold commercially by the SOCIETE CHIMIQUE DES CHARBONNAGES under the reference LOTREX FW 1180 and having a density equal to 0.935 and a fluidity index of 1.5 dg/min,

—40 parts by weight of an ethylene polymer sold commercially under the reference WACKER 5551 and having a density of 0.953 and a fluidity index of 0.25 dg/min,

—10 parts by weight of the polyethylene wax used in Example 2.

The composition obtained (density: 0.943, fluidity index 1.1 dg/min) makes it possible to obtain by extrusion an insulating material having a good surface condition.

Example 4

0.9 parts of the porogenic agent azodicarbonamide sold commercially by OLIN Company under the reference KEMPORE 125 MC are added to 100 parts by weight of the composition obtained in Example 1.

The composition obtained was extruded on an extruder achieving cellular insulation of telephone wires. The insulating material has a good surface appearance and has a compressive strength (according to the standard CM 25 of the Centre National d'Etudes des Telecommunications) of 1880N over 50 mm.

Example 5

0.8 parts of the porogenic agent azodicarbonamide sold commercially under the reference GENITRON EPD are added to 100 parts by weight of the composition obtained in Example 2.

The composition obtained was extruded on an extruder achieving cellular insulation of telephone wires. The insulating material has a good surface appearance.

CLAIMS

1. Polymer composition having a density comprised between 0.940 and 0.950 inclusively and a fluidity index less than 2 dg/min comprising 50 to 60% by weight of at least one copolymer A of ethylene and at least one α-olefin having 3 to 12 carbon atoms, the said copolymer having a density comprised between 0.932 and 0.940 and 40 to 50% by weight of at least one ethylene polymer B having a density comprised between 0.952 and 0.960, wherein:

a) the fluidity index of the copolymer A is comprised between 1.5 and 5 dg/min, and

b) the fluidity index of the polymer B is comprised between 0.15 and 0.4 dg/min.

2. Composition according to claim 1, additionally comprising from 3 to 10 parts by weight of at least one polyethylene wax having a molecular weight less than 6,000 per 100 parts by weight of the mixture of copolymer A and polymer B.

3. Composition according to claim 1 or 2, additionally comprising up to 1.5 parts by weight of a porogenic agent per 100 parts by weight of the mixture of copolymer A and polymer B, wherein the porogenic agent is chosen from compound shaving a diazene function.

4. Composition according to one of claims 1 to 3, wherein the copolymer A comprises units derived from at least one α-olefin having at least 4 carbon atoms, the distribution of the α-olefin units in the copolymer A is heterogeneous, said copolymer comprising crystalline fractions and amorphous fractions, and the content of α-olefin units in the copolymer varies between 0.2 and 5 times their average content according to the fractions considered.

5. Composition according to claim 1, wherein the polymer B is a copolymer of ethylene and at least one α-olefin having 3 to 12 carbon atoms.

6. Polymer composition substantially as hereinbefore described in any one of the Examples.

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